

REMARKS

By this Reply, Applicant amends claims 1, 16, 23, 29, 36, 43-45, 48, 49, 52, and 54. Paragraph 60 on page 13 of the specification has been amended to correct a typographical error. In view of the remarks set forth below, Applicant requests the prompt re-examination and allowance of this application. Claims 1-60 are pending in this application.

Claim Objections

In the Office Action of February, 2, 2007 ("Office Action"), the Examiner objected to claims 1 and 23 for minor informalities. Applicant submits that the objection has been addressed by the foregoing amendments. Particularly, claims 1 and 23 now recite "Pantelides."

Section 101 Rejection

In the Office Action, the Examiner maintained the rejections of claims 1-60 under 35 U.S.C. § 101 as being directed to nonstatutory subject matter. Particularly, the Examiner argued that these claims lack a practical application because they do not produce a "concrete, useful, tangible result" as required by MPEP § 2106. Office Action at 3-8. Applicant respectfully disagrees.

All of claims 1-60 recite methods or systems that produce tangible results. In the *State Street Bank* case, the Federal Circuit held that the tangible result of a process applying a mathematical algorithm was statutory because it resulted in "a final share price momentarily fixed for recording and reporting purposes." *State Street Bank & Trust Co.*, 149 F.3d 1373. Similarly, the steps recited in independent claims 1, 23, 43-45, 49, 53-55, 58 and 59 produce tangible results, e.g., generating and storing an output

defining a simulated system based on processed equations. These results are “real world” and not abstract. The Examiner asserts that claims 1-60 define nonstatutory subject matter because they are not “restricted to any field of application, or substantial practical use, that is more specific than ‘simulating a system’.” Office Action at 3. In other words, the Examiner asserts that specific methods of simulation, such as those defined by claims 1-60, are not patentable subject matter, and that simulation is not a practical application. This assertion is clearly erroneous.

It may be useful to illustrate by way of an example. Many different types of systems have complex behaviors that can be described in terms of a system of differential algebraic equations (DAE). For example, a backhoe loader has an excavation arm used to perform digging operations, which may be modeled as a four-bar linkage with one free end. The range of motion of the excavation arm as a whole can be described in terms of a system of differential algebraic equations defining the range of motion and the connection constraints of each linkage. It is useful to simulate the motion of the excavation arm when, for example, designing a computer system to control the digging operations of a backhoe loader, or providing a computer training simulator for new machine operators. Applicant’s claims provide a method of simulating such systems in a manner that reduces the processing burden on the computer. Therefore, Applicant’s claims define a process that results in a useful, concrete, and tangible result. It is noted that the claims of U.S. Patent 6,810,370 to Watts III issued on October 26, 2004, for example, are also directed to a method of processing equations to simulate a physical system.

As explained in the M.P.E.P., one way to show a practical application of a process is to show that the process results in a useful, concrete, and tangible result. M.P.E.P. § 2106(IV)(c)(2). As discussed above, independent claims 1, 23, 43-45, 49, 53-55, 58 and 59 recite processes that produce useful, concrete, and tangible results. Therefore, these claims describe a practical application of the claimed subject matter, and Applicant requests the withdrawal of the section 101 rejection of claims 1-60.

Section 103 Rejection

In the Office Action, claims 1-60 were rejected under 35 U.S.C. § 103(a) as unpatentable over Cellier et al., "Automated Formula Manipulation Supports Object-Oriented Continuous-System Modeling" ("Cellier") in view of Pantelides, C., "The Consistent Initialization of Differential-Algebraic Systems" ("Pantelides"). This rejection is traversed because a proper *prima facie* case of obviousness has not been made.

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a), each of three requirements must be met. First, the references, taken alone or combined, must teach or suggest each and every element recited in the claims. M.P.E.P. § 2143.03. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references in a manner resulting in the claimed invention. Id. at § 2143.01. Third, a reasonable expectation of success must exist that the proposed modification will work for the intended purpose. Id. at § 2143.02. Moreover, each of these requirements must "be found in the prior art, and not be based on applicant's disclosure." Id. at § 2143.

Independent claims 1, 23, 43-45, 49, 55, 58 and 59 recite subject matter neither taught nor suggested by Cellier and Pantelides, taken individually or in combination. For example, these claims recite methods of simulating a system including, among other things, “eliminating an integral ... wherein eliminating an integral includes assigning a preferred integration location rank to one or more integrals.” Cellier discloses methods of manipulating formulas in object-oriented system modeling. Cellier, at 28. The Examiner admits that Cellier does not teach “wherein eliminating an integral includes assigning a preferred integration location rank to one or more integrals.” Office Action at 9 and 15-18.

The Examiner introduces Pantelides to remedy the deficiencies of Cellier. However, Pantelides also fails to disclose or suggest methods of simulating a system including, among other things, “eliminating an integral ... wherein eliminating an integral includes assigning a preferred integration location rank to one or more integrals.” Pantelides discloses an algorithm to analyze a system of differential algebraic equations (DAE) to determine a minimal subset of the system that must be differentiated to generate a non-singular system that imposes useful constraints on the initial conditions of the system. Pantelides, at 213, 214, 222, 231. However, Pantelides does not disclose nor suggest assigning an integration location rank to any equations in the DAE system or any subsets thereof. The Examiner asserts that Pantelides expressly teaches this limitation, yet provides no citation where it may be found or suggested. Office Action at 9 and 15-18. Although Pantelides refers to a “row rank” on pages 215 and 221, a row rank is wholly unrelated to “eliminating an integral ... wherein eliminating an integral includes assigning a preferred integration location rank to one or more

integrals,” as required by claims 1, 23, 43-45, 49, 55, 58 and 59. A row rank refers to the number of rows in a matrix. For example, Pantelides teaches that the “row rank” of the matrix C, or the number of rows therein, defines the number of new equations which the original variable set must satisfy. Pantelides, at 215. Further, Pantelides does not teach that the row rank is utilized to integrate the equations in any manner, much less to assign or otherwise define a preferred integration location rank. To the contrary, as mentioned above, Pantelides is concerned with determining a minimum subset of the original system of equations that need to be *differentiated*. Pantelides, at 213, 214, 222, 231.

For these reasons, Cellier and Pantelides fail to disclose each and every element recited in independent claims 1, 23, 43-45, 49, 55, 58 and 59. Therefore, Applicant requests the withdrawal of the § 103 rejection and the timely allowance of these claims. Further, since claims 2-22, 24-42, 46-48, 50-52, 56-57, and 60 each depend directly or indirectly from independent claims 1, 23, 45, 49, 55, or 59, Applicant respectfully requests the withdrawal of the § 103 rejection and the timely allowance of these claims.

Independent claims 53 and 54 also recite subject matter neither taught nor suggested by Cellier and Pantelides, taken individually or in combination. For example, these claims recite methods of simulating a system comprising, among other things, “performing a tearing process on a set of equations, including: identifying block variables in the equations in a block in which the block variables appear linearly with constant coefficients ...determining the solvability of the nonlinear equations ... solving the nonlinear equations utilizing iterates and block variables solved from the linear equations ... [and] scanning for solved for variables for identification of variables that

are independent and may be removed from the block.” The Examiner alleges that Cellier discloses this subject matter on pages 35-37. This assertion is incorrect. As discussed above, Cellier discloses methods of manipulating formulas in object-oriented system modeling. Cellier, at 28. Particularly, Cellier discloses a method whereby equations that model a system are defined, the resulting system of equations is differentiated to remove a constraint on the system, and initial values are assigned to the system consistent with the removed constraint. Cellier, at 34-35. However, Cellier does not teach that block variables are identified in the system of equations or subsets thereof, nor that the solvability of the equations are determined. Further, Cellier does not teach solving the equations using nonlinear iterates and block variables, nor that the system of equations is scanned for solved variables for identification of variables that are independent and may be removed from the block.

Pantelides also fails to remedy the deficiencies of Cellier. As mentioned above, Pantelides discloses an algorithm to analyze a system of differential algebraic equations (DAE) to determine a minimal subset of the system of equations that must be differentiated to generate a non-singular system. Pantelides, at 213, 214, 222, 231. However, Pantelides does not disclose nor suggest the subject matter of claims 53 and 54 discussed above.

Applicant notes that the rejection of claims 53 and 54 is not in accordance with PTO rules and MPEP practice. The Examiner is required to explain the pertinence of each reference relied upon in the rejection. 37 C.F.R. § 1.104(c). The MPEP requires the Examiner to set forth “the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s).” M.P.E.P.

§ 706.02(j). Further, “[t]he goal of examination is to clearly articulate any rejection early in the prosecution process so that the applicant has the opportunity to provide evidence of patentability and otherwise reply completely at the earliest opportunity.” 37 C.F.R. § 1.104(c). The rejection of claims 53 and 54 does not comply with such practice.

Particularly, the rejection states that “Cellier, however, does not expressly teach the following limitation,” and “Pantelides, on the other hand, expressly teaches that limitation,” but continues without identifying the limitation. Office Action at 21. Further, the alleged teachings of Cellier on the previous page include all of the subject matter recited in claim 53. Office Action at 20. Therefore, the rejection of claims 53 and 54 is also unclear. Should the Examiner continue to dispute the patentability of these claims, Applicant requests a new non-final Office Action identifying where the cited references support the Examiner’s assertions that the limitations of claims 53 and 54 are disclosed.

For these reasons, Cellier and Pantelides fail to disclose each and every element recited in independent claims 53 and 54. Therefore, Applicant requests the withdrawal of the § 103 rejection and the timely allowance of these claims.

Furthermore, the dependent claims contain many additional recitations that are neither taught nor suggested by the cited references. For example, claims 20 and 40 recite additional subject matter directed to replacing alias variables, partitioning the equations into blocks, tearing the blocks, sorting the blocks, and compressing equation terms. As discussed above in connection with claims 53 and 54, neither Cellier nor Pantelides discloses nor suggest identifying or manipulating blocks within the system of equations or subsets thereof. For these additional reasons, Applicant requests the withdrawal of the § 103 rejection and the timely allowance of these dependent claims.

Conclusion

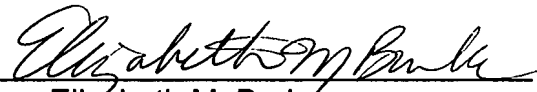
Applicant requests the reconsideration of this application in view of the foregoing and the timely allowance of pending claims 1-60.

Please grant any extensions of time required to enter this response and charge any additional required fees to our Deposit Account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

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By: 
Elizabeth M. Burke
Reg. No. 38,758